A Cooperative Pilot Project on Weather and Emergency Management Decision Support

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Weather and Emergency Management (WxEM)

- To understand the potential impact of NWS products & services on critical EM decisions by examining EM processes, collaborations, and product & services utilization.
- Collaborators
  - RENCI
  - East Carolina University
  - NWS OS&T
  - NWS OCWWS
  - NOAA GSD
  - Local NWS Offices

Project Goals

- Enhance the infusion of weather and climate information into **decision processes for risk and crisis management**
- Develop prototypes that **enable effective weather translation**
- Explore collaborative technologies to **facilitate knowledge exchange and situational understanding**
- **Demonstrate an incremental and iterative prototyping** process that shows the inclusion of social science analysis and evaluation of decision support applications, technology enhancements, and infusion into practice.

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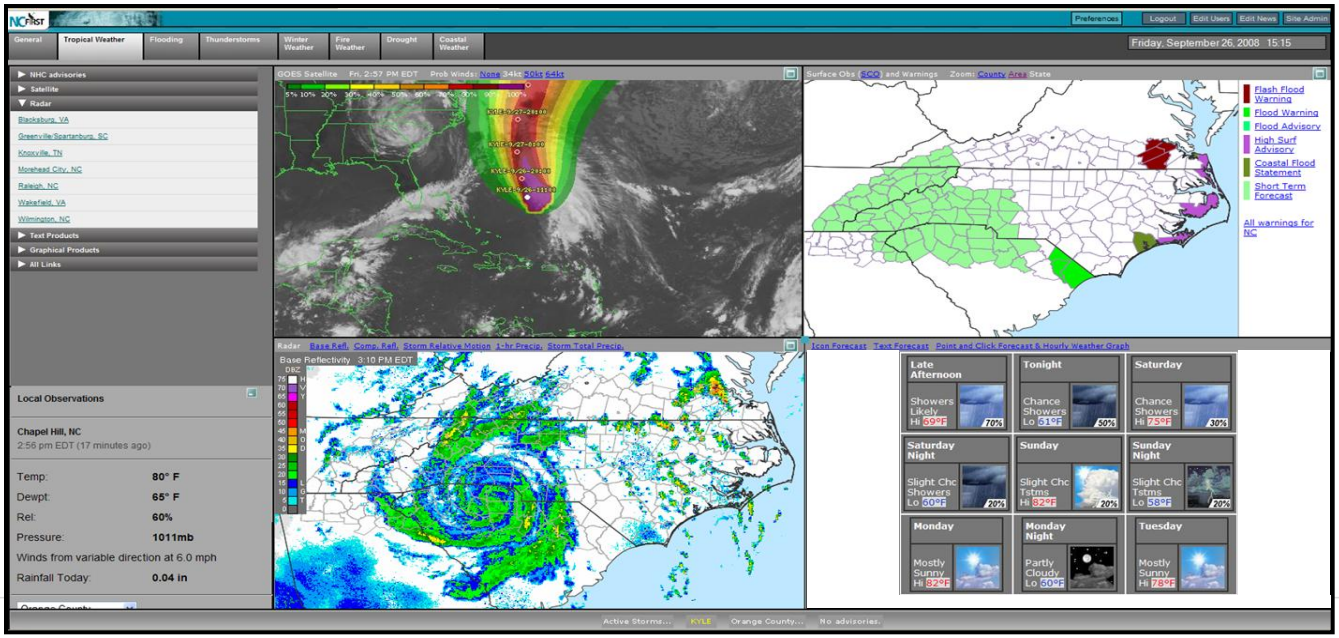
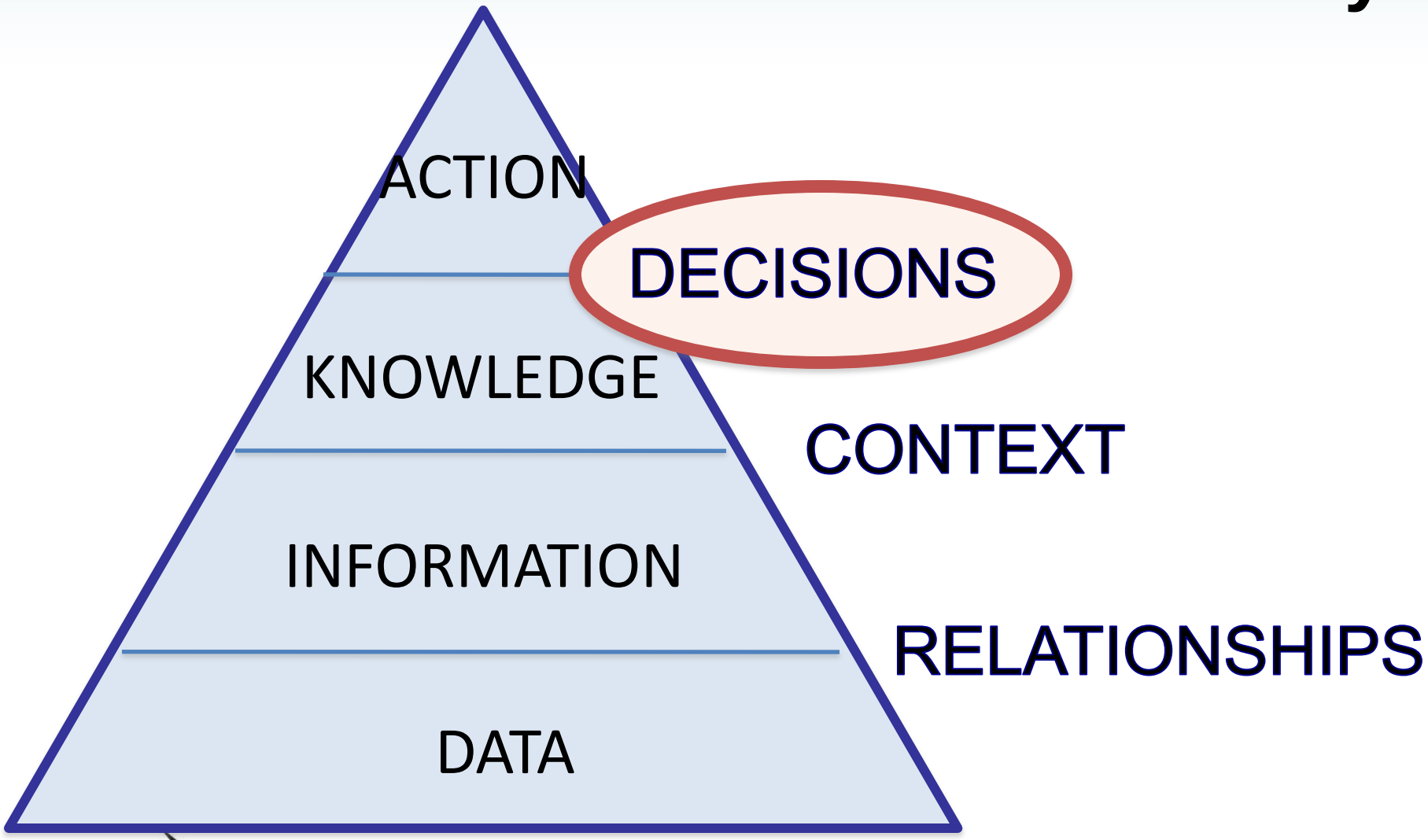
How WxEM Began

- NC-FIRST (collaboration with NWS WFO's)
  - EMs have trouble finding & understanding weather info
  - Weather information portal & training for NC EMs
  - Now standard tool in NC EM community
- Still not resolving the whole problem
  - Info can be hard to relate to decisions & impacts



“Information” Hierarchy



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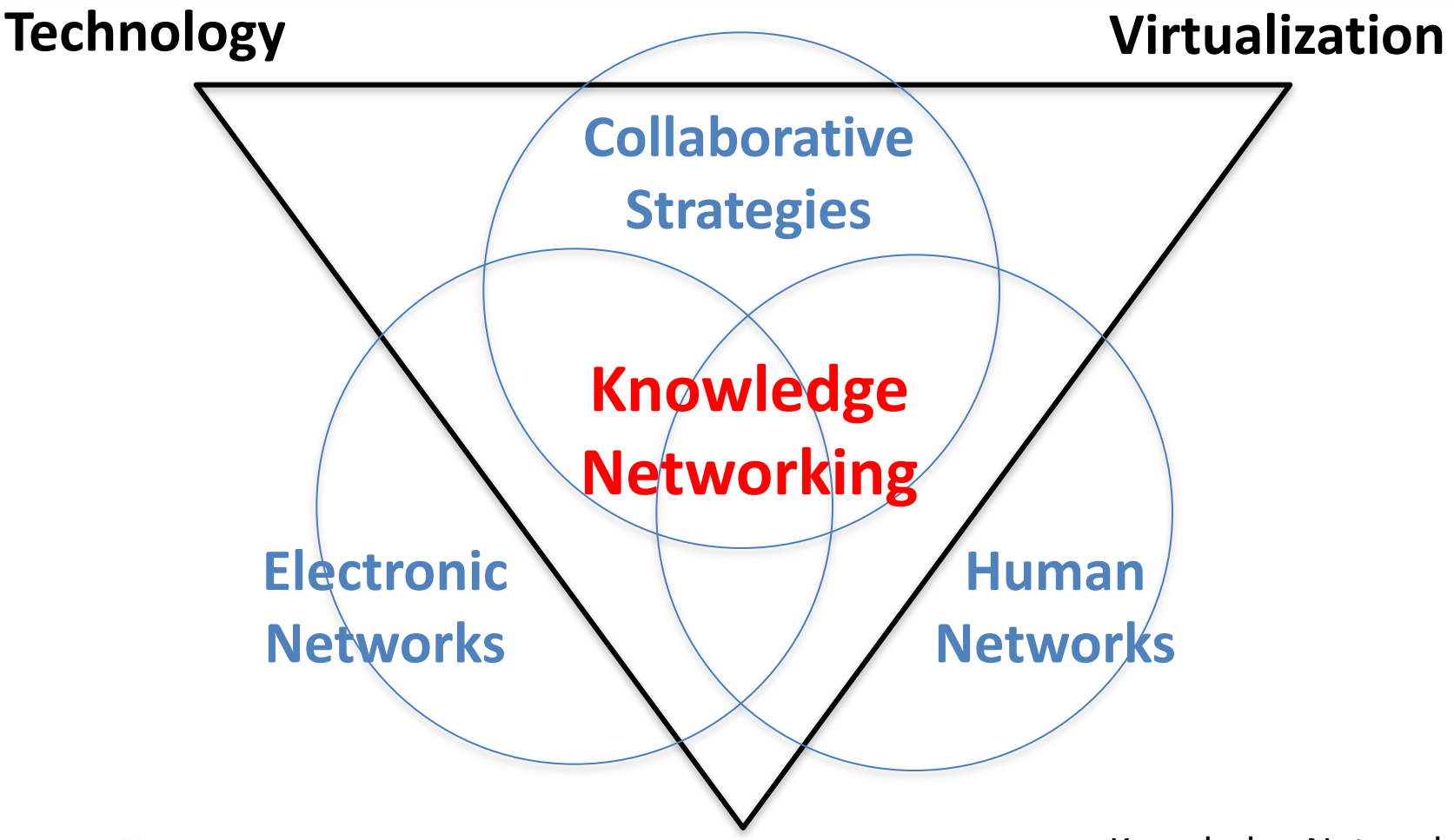
Knowledge to Decisions



Knowledge Networking
Skyrme, D.J.1999

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WxEM Knowledge Elements

- Human Dynamics-Social Science
  - Learn about decision processes, info flow, communication between groups
- Technology
  - From decision makers' perspective
  - How to translate, transmit, transform information to be usable
  - Rapidly develop prototypes to test
- Collaboration
  - Enables knowledge to be conceptualized, conveyed
  - Person-to-person & human-to-computer interaction

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Approach (Knowledge to Decisions)

- Step 1: Understand Emergency Management (EM)community - baseline
  - Who are they, what do they do, who do they work with, what are their key decisions?
- Step 2: How is weather information currently used in risk and crisis management.
  - What products and services are used. Are they understood and effective?
- Step 3: What are the gaps and deficiencies
  - How might it be done differently?
- Step 4: Apply to next case or iteration

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First Steps

- Understand processes beyond the county EM director
- Winter weather use case
- 3 focus groups
- 5 weather time scenarios
- Collected data via CRC Cards
  - Who, what, when, how, why

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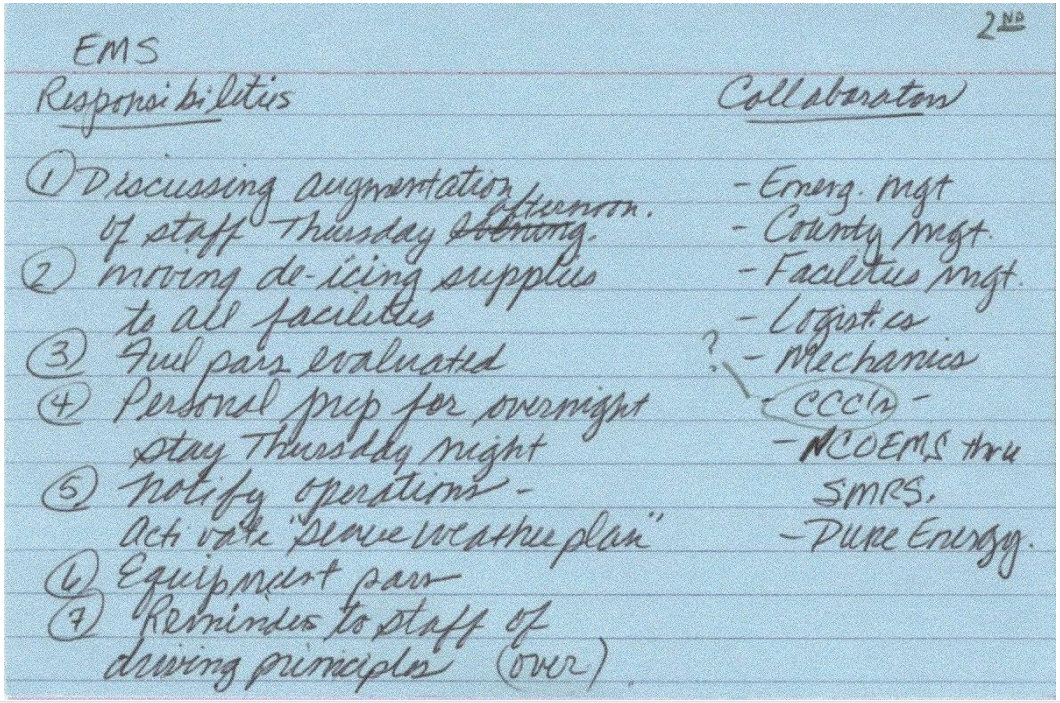
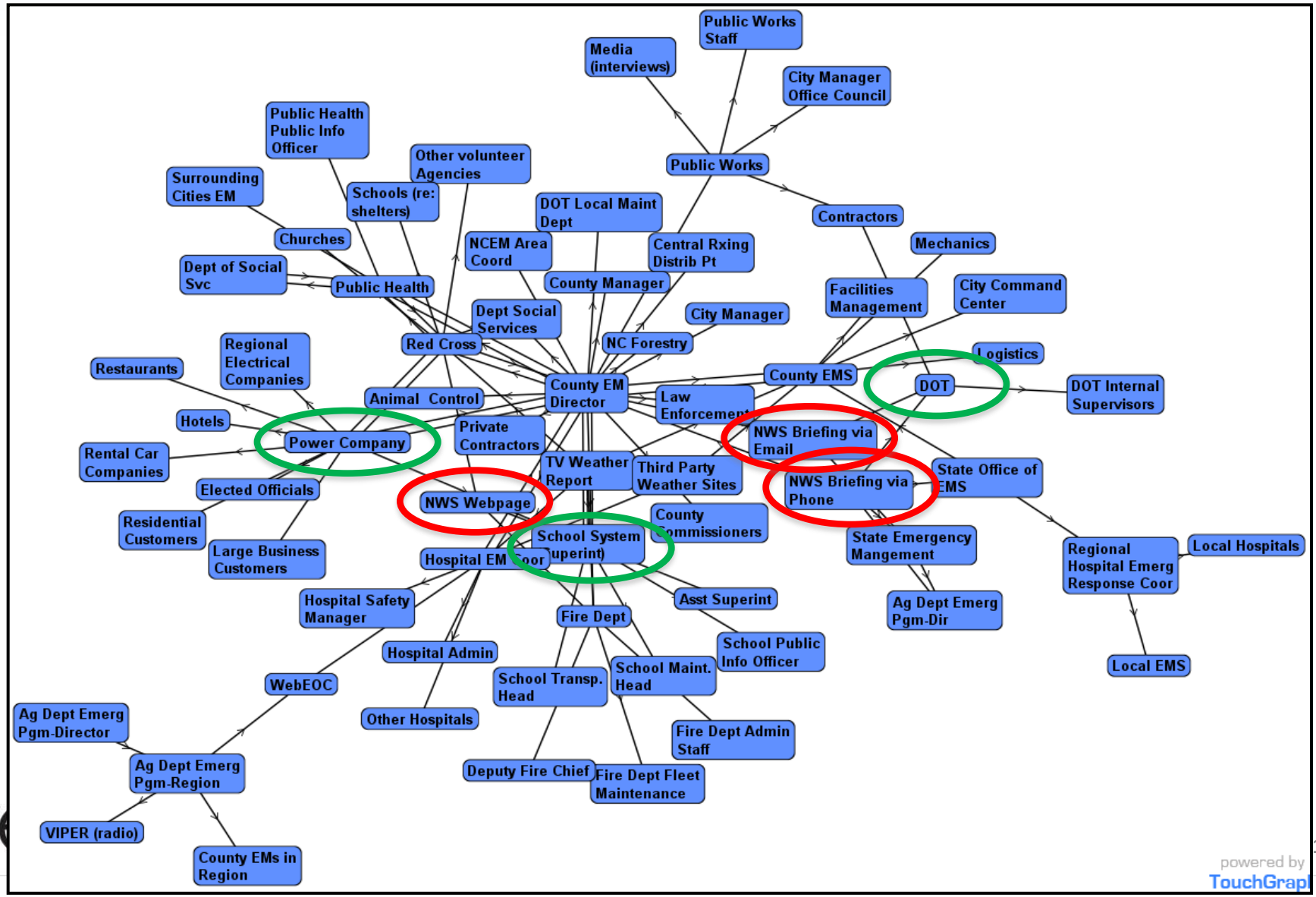
Emergency Support Function
#1: Transportation
#2: Communications
#3: Public Works and Engineering
#4: Firefighting
#5: Emergency Mgmt
#6: Mass Care, Emergency Assistance, Housing, and Human Services
#7: Logistics Mgmt and Resource Support
#8: Public Health and Medical Svc
#9: Search and Rescue
#10: Oil and HazMat Response
#11: Ag and Natural Resources
#12: Energy
#13: Public Safety and Security
#14: Long-Term Community Recovery
#15: External Affairs

CRC Cards

- Class, Responsibility, and Collaboration
- Originally used for software design (Beck & Cunningham, 1989)
- Consistent way to collect information



CRC Cards to Knowledge Map



powered by TouchGraph

Winter Use Case: Critical Sub-Groups

- Critical Decision Makers: societal impact (on people)
  - Power companies (private sector)
  - DOT (complicated across jurisdictions)
  - Schools (underserved and impacts are large)
- Focus: Schools
  - What is the inclement weather decision process
  - Compare to county EM directors for generalization

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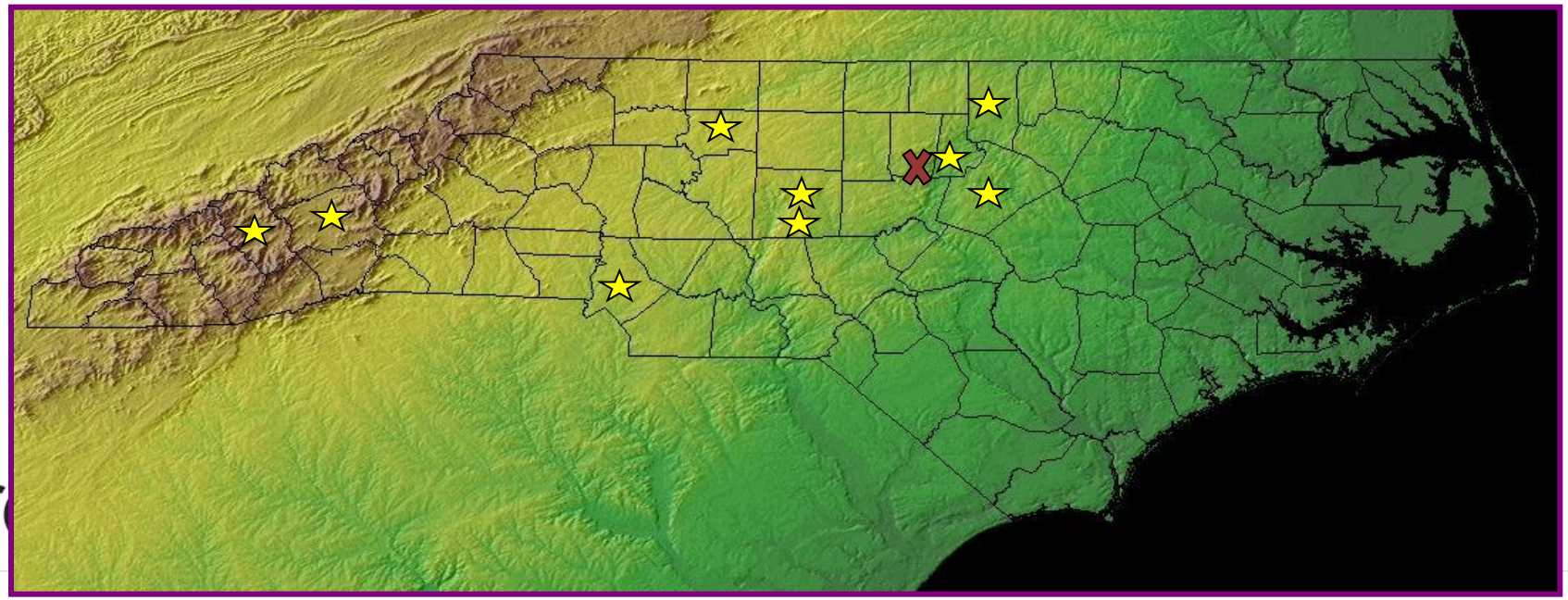
School Use Case

- 3 rounds of development/testing
- 9 test schools
  - Chosen based on level of interaction with local NWS
  - Rural/urban
  - Geography across state
- 

School Interviews

- Round 1: establish basic process
- Who gathers info?
  - Mostly transportation directors
  - Not trained on using weather information
  - Communication
- What info is needed to make decision?
  - Can struggle to find & understand this info
  - Onset time of precip, precip type, duration
  - Road conditions, road temperature

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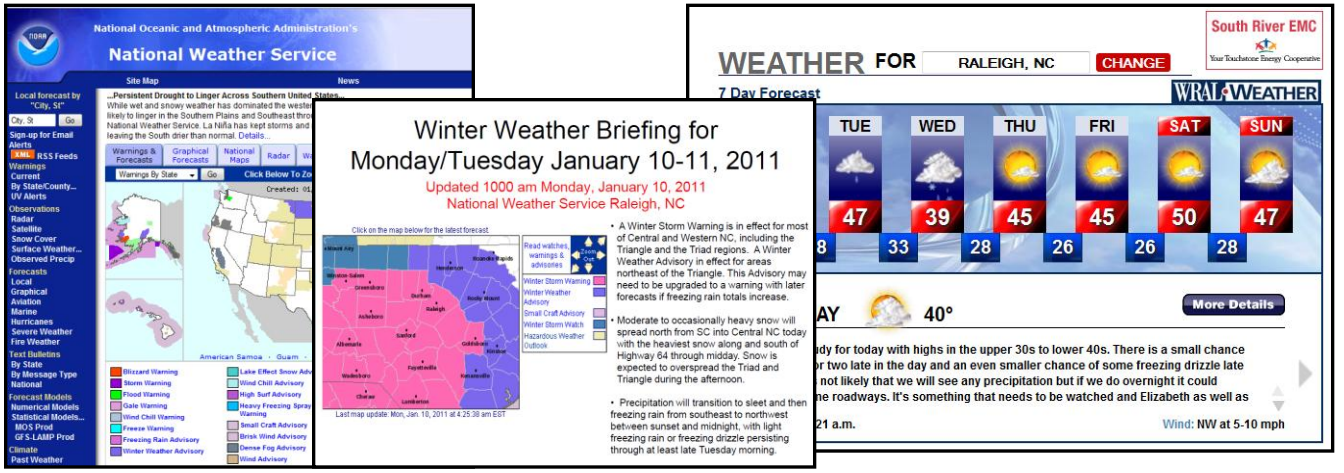
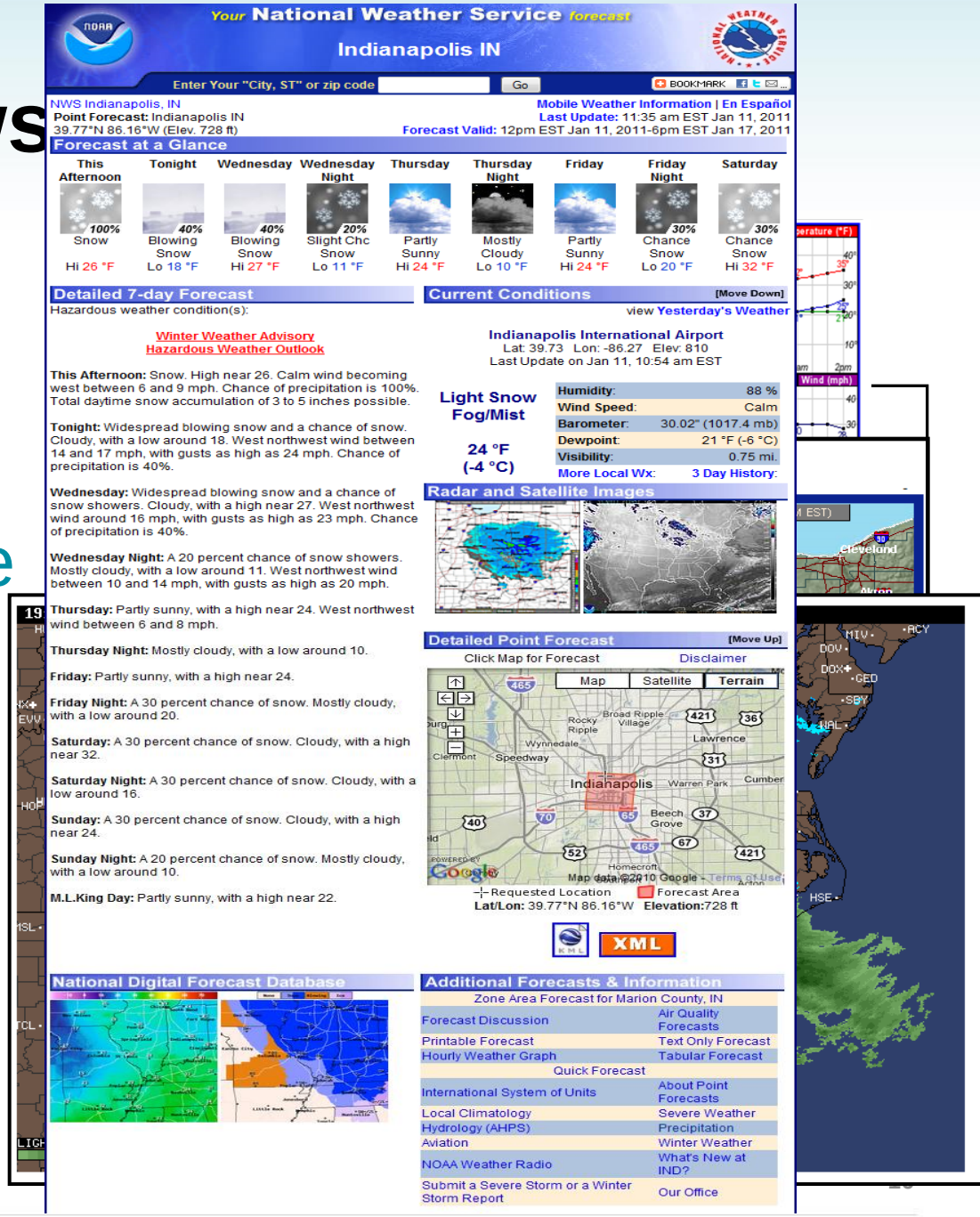
School Interviews

- Sources of info
  - Unanimous: TV
  - NWS: web page, email briefings, or phone calls
  - 1 uses no NWS info directly
  - 1 not aware NWS could be contacted for info
  - Not much interaction with county EM



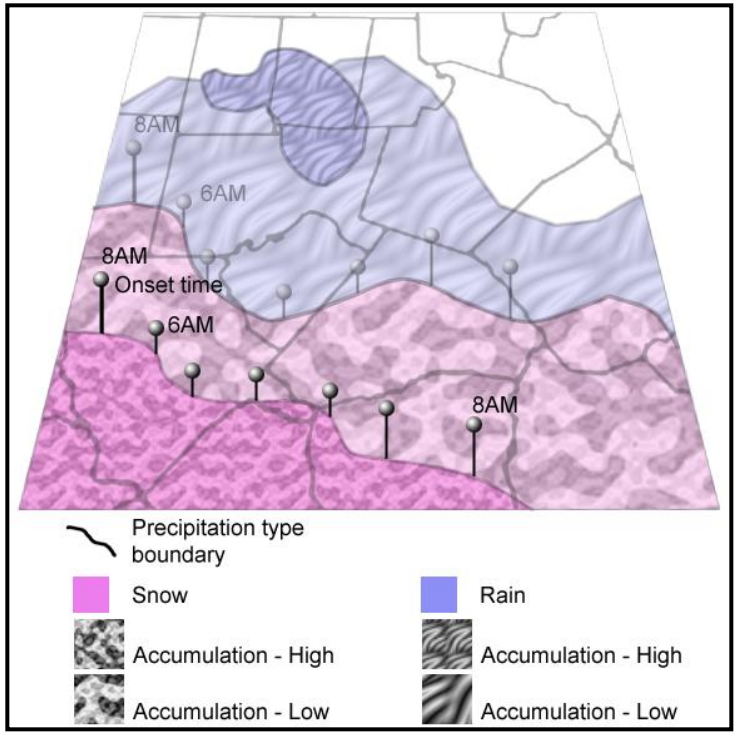
School Interviews

- Round 2: follow-up after real storm
  - Timeline
  - Specific products
- Round 3: knowledge testing
  - Interpreting current products correctly?
  - Aware of existing NWS products?
- Survey



Rapid Prototyping

- Send ideas to 3 school reps
- Forecast Information Prototype
  - Take NWS forecast grids – visualize according to feedback
- Real-time Gathering & Sharing Prototype
  - “Map conferencing”
  - Share road temps, conditions, etc. in real-time for everyone to see



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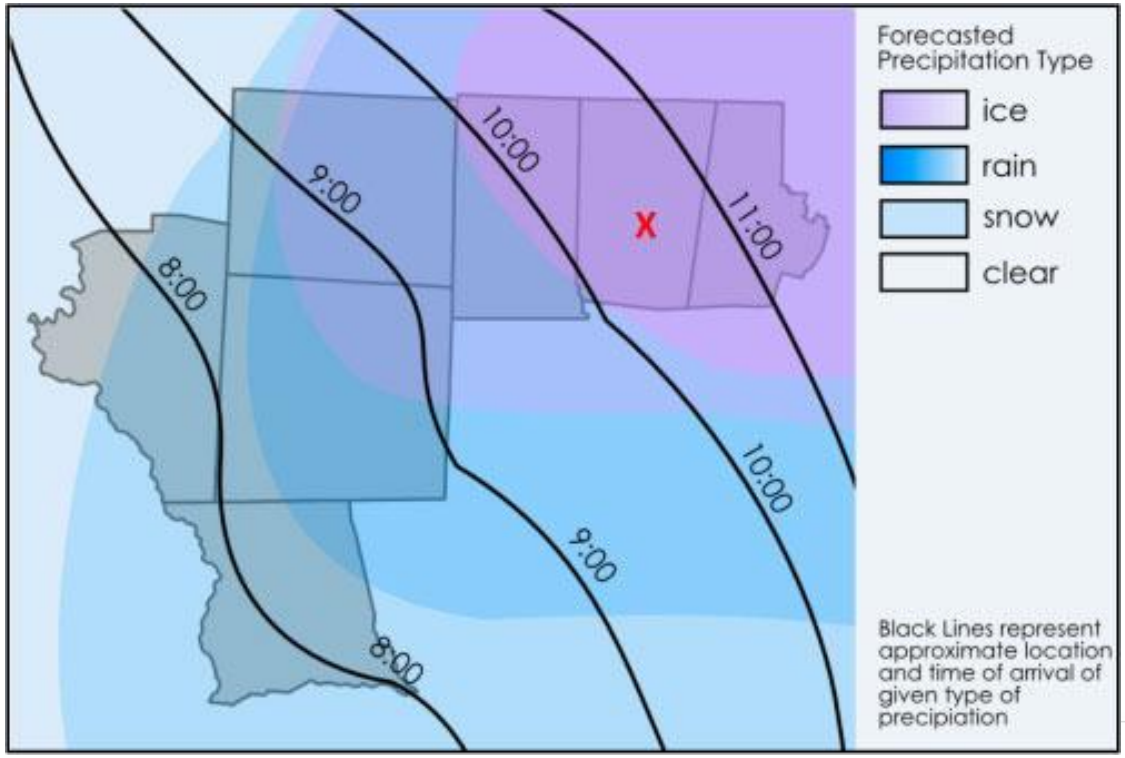
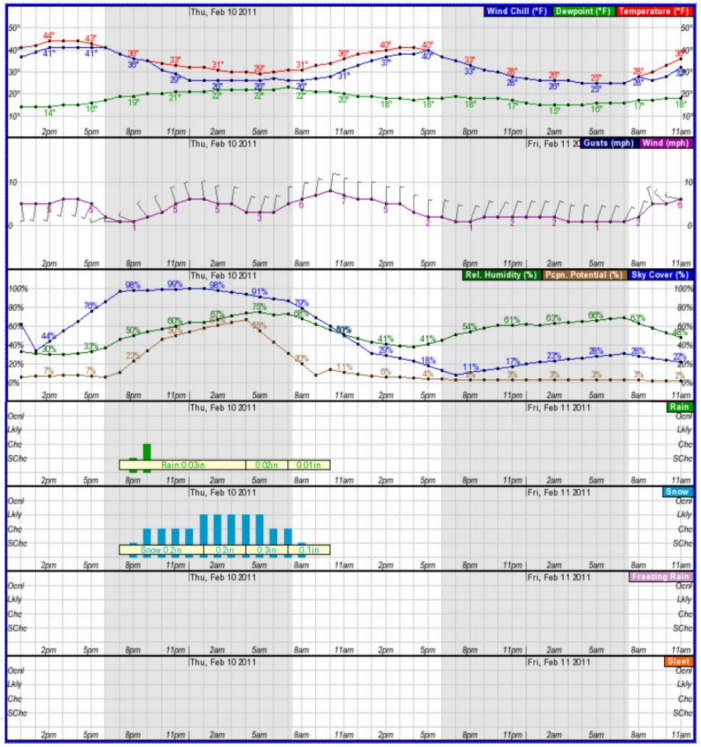
Onset Time of Precip Prototype

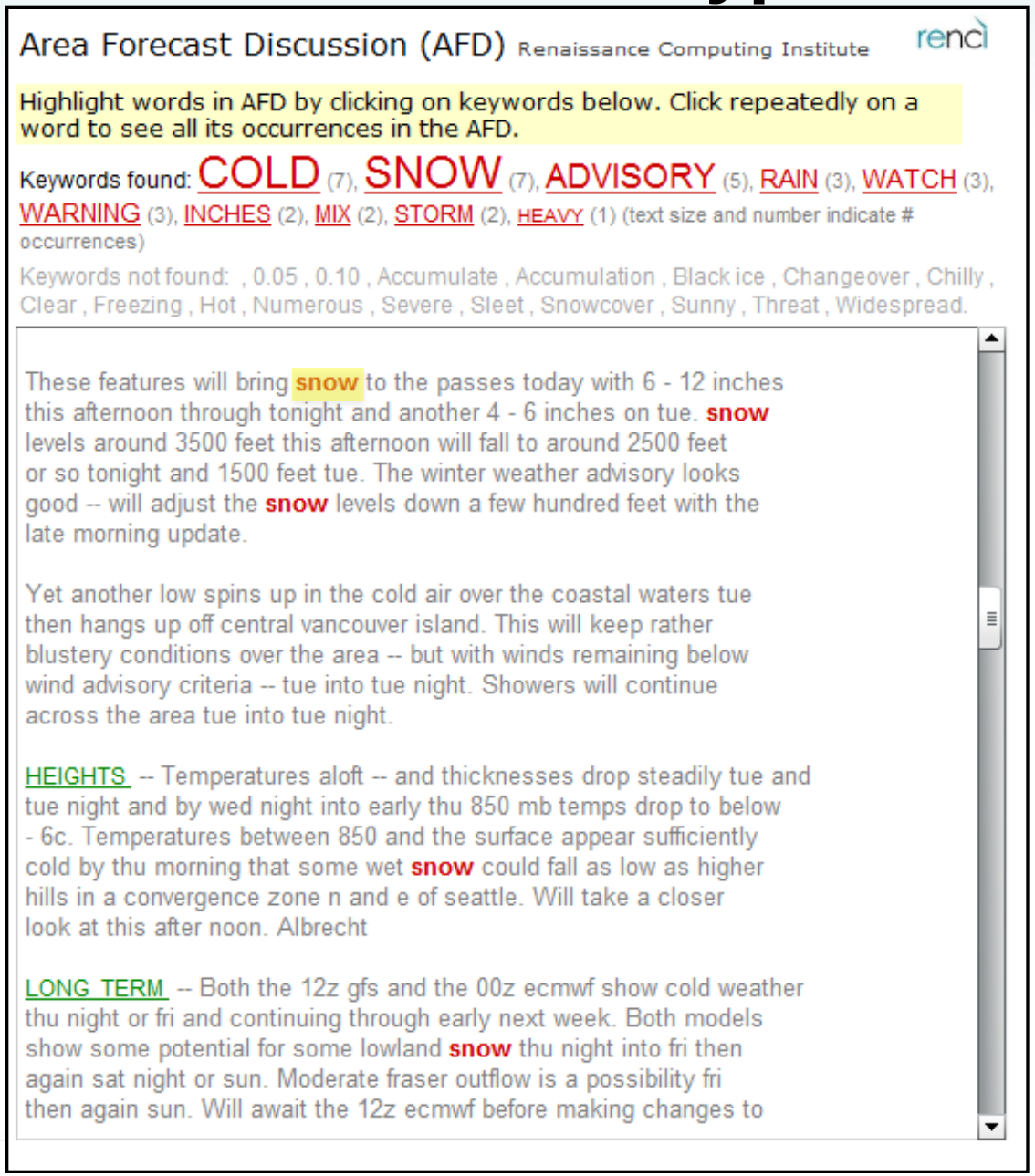
- Highest ranked:
  - Map with times
  - NWS Hourly Weather Graph
  - Combine on one display?





Area Forecast Discussion Prototype

- Highlight keywords, click to find
- Lower case letters



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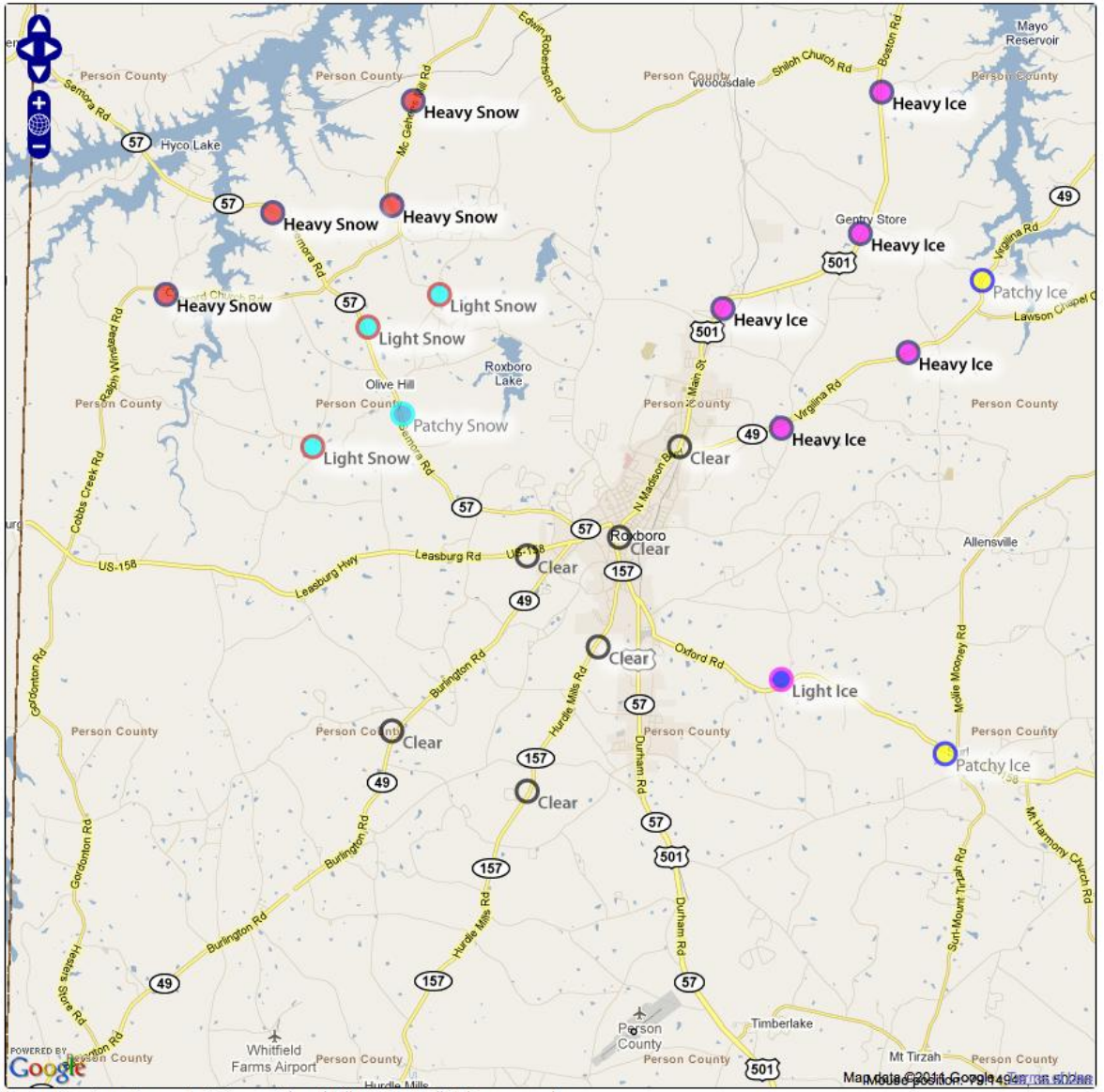
Gathering & Sharing Prototype

- Real-time reports from school transportation reps



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School Exercise (Gaps and Future)

- Visited with reps from 7 schools
  - Informal exercise using historical case
  - Provided scenario and P&S that would likely be used during event, held open discussion
- Provided further confirmation of awareness and effectiveness of products and services
- New schools provided additional insight
  - Example: unaware of products, such as HWG, that were popular with other schools

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Preliminary Findings – Winter Weather

- Major decision consideration: teenage drivers' (75,000 in NC) lack of experience
- Decisions are made based on road hazards
  - Need forecasted and current road condition products
- Use of NWS P&S varies greatly across schools
- School reps have very little formal weather training
- Briefing packages by NWS need to be decision oriented
- Putting relevant weather information for schools all in one place would be highly valuable
- Increased awareness of NWS P&S is needed for schools
  - Example: in informal survey, ~1/3 have never heard of the hourly weather graph

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Current Work (May-June)

- Replicate the approach and methods, for new use case
- Tropical weather use case underway
  - Annual NC Hurricane Workshop surveys
  - 4 focus groups in SE NC (3 counties) and NE SC (1 counties)
- Selected preliminary findings
  - MOMs/MEOWs stressed, but EMs are not using them. At workshop no one explained how to find them.
  - P-surge information issued within 48 hr of landfall – not useful operationally pre-storm, but is useful for recovery planning
  - Critical operational concern: arrival of tropical storm force winds (flooding, surge less so) out to 96 hours or more
  - Tendency towards probabilistic information, explore further: do they understand it, presentation preferences

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Year 2

- Second year (to be discussed at final quarterly review, 30 June 2011)
  - Continue tropical weather use case
    - Follow up on questions stemming from workshop and focus groups
    - Observe EM community during storms impacting NC
  - Continue exploring winter weather decisions during events
    - NC-FIRST for Schools
    - BigBoard

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Summary

- Findings and recommendations intended to inform potential impact of NWS products & services on critical EM decisions
- Broader Issues: (based on winter weather case study)
  - Struggling to find/understand weather information
  - Biggest need: confidence in forecast and how it is conveyed
  - Available information isn't always pertinent to decisions they need to make
  - EM social networks are functional, but not optimal for weather information
  - Decision makers are not weather savvy, and therefore rely on interpretations from many sources
- Approach and methods being applied to tropical weather:
  - Preliminary data collected, much more to explore on product usage, understanding, critical decisions, timelines
  - Went in "looking" for evacuation issues, as part of coordinated effort (different than approach of winter weather, more general questioning)

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